

What is claimed:

1 1. A method of manufacturing a monolithic stabilized electroabsorption
2 modulator which includes a substrate with a top surface and substrate index of refraction;
3 a waveguide layer with an output optical tap section and an electroabsorption section
4 arranged along a longitudinal axis; and a semiconductor layer, the method comprising the
5 steps of:

6 a) forming a waveguide layer having a waveguide index of refraction different
7 from the substrate index of refraction on the top surface of the substrate, the waveguide
8 layer including an electroabsorption portion adjacent to the output optical tap portion;

9 b) forming the semiconductor layer on the waveguide layer, the semiconductor
10 layer including a semiconductor layer index of refraction different from the waveguide
11 index of refraction;

12 c) defining and etching the waveguide layer and the semiconductor layer to
13 form mesa structure;

14 d) depositing a base electrical contact on the substrate; and

15 e) depositing a modulator electrical contact and an output optical tap electrical
16 contact on the semiconductor layer.

1 2. The method of claim 1, wherein step (a) further includes the step of forming
2 a plurality of sub-layers in the electroabsorption portion of the waveguide layer to form a
3 quantum well structure, each of the sub-layers including a waveguide material.

1 3. The method of claim 2, wherein step (a) further includes the steps of:

2 a1) forming at least one patterned growth retarding layer on the top surface of
3 the substrate;

4 a2) forming the waveguide layer on a portion of the top surface of the substrate
5 by selective area growth.

1 4. The method of claim 3, wherein the step of forming the patterned growth
2 retarding layer includes forming a plurality of growth retarding elements, the growth
3 retarding elements defining a channel extending along a central portion of the longitudinal
4 axis.

1 5. The method of claim 3, wherein step c) further includes the step of
2 removing the growth-retarding layer.

1 6. A method of stabilizing an extinction ratio of a monolithic stabilized
2 electroabsorption modulator, including an input optical tap, an electroabsorption
3 modulator, and an output optical tap, the method comprising the steps of:

4 a) supplying a bias voltage to the input optical tap, the electroabsorption
5 modulator, and the output optical tap;

6 b) detecting an input tap current of the input optical tap and an output tap
7 current of the output optical tap;

8 c) calculating the extinction ratio of the electroabsorption modulator based on
9 the input tap current and the output tap current measured in step (b); and

10 d) varying the bias voltage based on the extinction ratio calculated in step (c)
11 to maintain the extinction ratio approximately at a predetermined level.

1 7. The method of claim 6, wherein:

2 the monolithic stabilized electroabsorption modulator further includes a
3 semiconductor optical amplifier; and

4 step (a) further includes the step of supplying an amplification current to the
5 semiconductor optical amplifier.

1 8. The method of claim 7, wherein step (d) further includes the step of varying
2 the amplification current based on the input tap current measured in step (b) to control
3 the input tap current at a second predetermined level.

1 9. The method of claim 7, wherein:

2 step (a) further includes the steps of;

3 a1) supplying a DC amplification current to the semiconductor optical
4 amplifier, the DC amplification current having a DC level;

5 a2) supplying an AC amplification current to the semiconductor optical
6 amplifier, the AC amplification current having an AC level and an AC frequency;

7 step (b) further includes the step of synchronously detecting the input tap current
8 and the output tap current at the AC frequency.

1 10. The method of claim 9, wherein step (d) further includes the step of varying
2 the DC amplification current based on the input tap current measured in step (b) to
3 maintain the input tap current approximately at a second predetermined level.

1 11. The method of claim 6, wherein:

2 step (a) further includes the steps of;

3 a1) supplying a DC bias voltage to the input optical tap, the
4 electroabsorption modulator, and the output optical tap, the DC bias voltage having
5 a DC voltage level;

6 a2) supplying an AC bias voltage to the input optical tap and the output
7 optical tap, the AC bias voltage having an AC voltage level and a tap frequency;

8 step (b) further includes the step of synchronously detecting the input tap current
9 and the output tap current at the tap frequency.

1 12. The method of claim 11, wherein step (a2) further comprises the step of
2 supplying the AC bias voltage to the electroabsorption modulator.

1 13. The method of claim 6, wherein:

2 step (a) further includes the steps of;

3 a1) supplying a DC bias voltage to the input optical tap, the
4 electroabsorption modulator, and the output optical tap, the DC bias voltage having
5 a DC voltage level;

6 a2) supplying an AC bias voltage to the electroabsorption modulator, the
7 AC bias voltage having an AC voltage level and a variation frequency;

8 step (b) further includes the step of synchronously detecting the input tap current
9 and the output tap current at the variation frequency.

1 14. A method of stabilizing an extinction ratio of a monolithic stabilized
2 electroabsorption modulator, including an electroabsorption modulator and an output
3 optical tap, the method comprising the steps of:

4 a) supplying an input optical signal to the monolithic stabilized
5 electroabsorption modulator;

6 b) supplying a bias voltage to the electroabsorption modulator and the output
7 optical tap, the bias voltage having a voltage level;

8 c) generating a periodic variation in the input optical signal, the periodic
9 variation having a variation amplitude and a variation frequency;

10 d) synchronously detecting an output tap current of the output optical tap at
11 the variation frequency;

12 e) calculating the extinction ratio of the electroabsorption modulator based on
13 the output tap current measured in step (d); and

14 f) varying the voltage level based on the extinction ratio calculated in step (e)
15 to maintain the extinction ratio approximately at a predetermined level.

1 15. The method of claim 14, wherein step (c) includes the step of supplying an
2 AC bias voltage to the electroabsorption modulator to generate the periodic variation in
3 the input optical signal.

1 16. The method of claim 14, wherein:

2 the monolithic stabilized electroabsorption modulator further includes a
3 semiconductor optical amplifier; and

4 step (b) further includes the step of supplying an amplification current to the
5 semiconductor optical amplifier.

1 17. The method of claim 16, wherein step (f) further includes the step of varying
2 the amplification current based on the tap current measured in step (d) to maintain the
3 tap current approximately at a second predetermined level.

1 18. The method of claim 16, wherein step (c) includes the step of supplying an
2 AC amplification current to the semiconductor optical amplifier to generate the periodic
3 variation in the input optical signal.

1 19. The method of claim 18, wherein step (f) further includes the step of varying
2 the DC amplification current based on the tap current measured in step (d) to control the
3 tap current at a second predetermined level.

1 20. A method of stabilizing an extinction ratio of a monolithic stabilized
2 electroabsorption modulator, including a temperature control element, a temperature
3 sensor, an electroabsorption modulator, and an output optical tap, the method comprising
4 the steps of:

- 5 a) supplying a bias voltage to the electroabsorption modulator and the output
6 optical tap;
- 7 b) supplying a temperature control voltage to the temperature control element;
- 8 c) measuring a temperature of monolithic stabilized electroabsorption
9 modulator using the temperature sensor;
- 10 d) varying the temperature control voltage based on the temperature
11 measured in step (c) to regulate the temperature of monolithic stabilized electroabsorption
12 modulator to an operating temperature;
- 13 e) detecting an output tap current of the output optical tap;
- 14 f) calculating the extinction ratio of the electroabsorption modulator based on
15 the output tap current measured in step (e); and
- 16 g) varying the operating temperature based on the extinction ratio calculated
17 in step (f) to control the extinction ratio at a predetermined level.

1 21. The method of claim 20, further comprising the step of:

- 2 h) varying the bias voltage based on the extinction ratio calculated in step (f)
3 to control the extinction ratio at a predetermined level.

1 22. The method of claim 21, wherein:

2 the monolithic stabilized electroabsorption modulator further includes an input
3 optical tap;

4 step (a) further includes the step of supplying the bias voltage to the input optical
5 tap;

6 step (e) further includes the step of detecting an input tap current of the input
7 optical tap; and

8 step (f) includes the step of calculating the extinction ratio of the electroabsorption
9 modulator based on the input tap current and the output tap current measured in step (e)